



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services

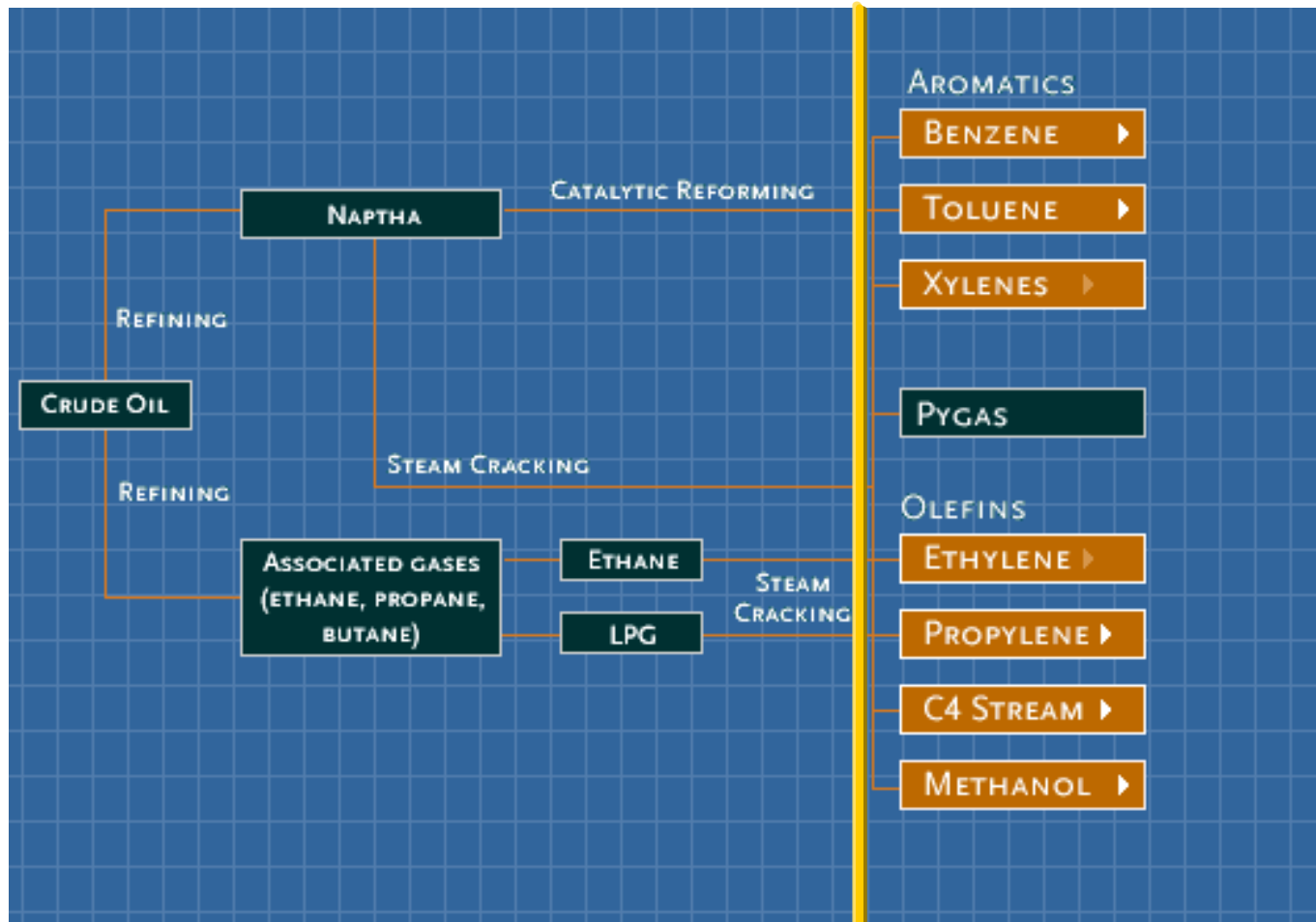


Solutions

Petrochemical Industry

Example: Purified Terephthalic Acid and Polypropylene

Petrochemicals



Oil & Gas

Petrochemical

About 250 chemicals are petrochemical products.

Purified Terephthalic Acid

TEREPHTHALIC ACID

CAS NUMBER : 100-21-0

EINECS NUMBER : 202-830-0

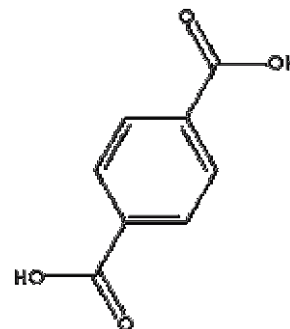
OTHER CHEMICAL NAME(S):

Benzene-1,4-dicarboxylic acid

p-benzenedicarboxylic acid

p-Phthalic Acid

MELTING POINT(S): >300 C



Precaution in handling

Physical Dangers: Dust explosion possible if in powder or granular form, mixed with air.

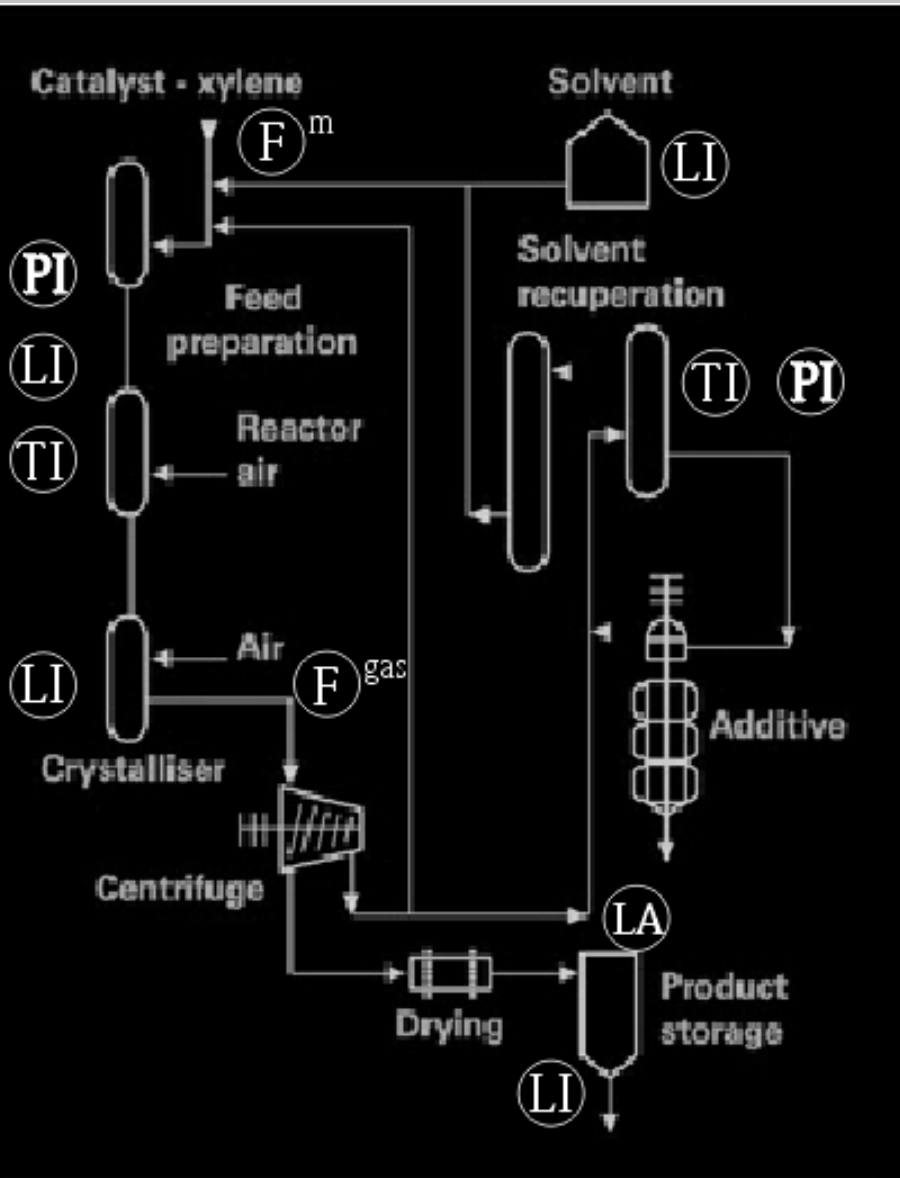
Chemical Dangers: Reacts violently with strong oxidants.

Occupational Exposure Limits (OELs): TLV not established.

Application

Polyester Fiber, Pet Bottle, Polyester Ashesive,
Polyester Film (Audio/Video Tape, X-ray Film, Photo Film),
Engineering Plastics

Terephthalic Acid



Step 1:

PX + catalyst + oxygen + acetic acid



CTA

(after centrifuge and drying = white powder = crude terephthalic acid)

The solvent is recovered in a distillation unit.

CTA - level measurement in oxidation reactor



Stage 1
















Source is placed in the vessel wall
 vessel wall is reduced
 2 detectors in parallel for double sensitivity



Stage 3

From stage 1 to stage 3 the pressure is reduced : Less thick tank walls. One detector only + standard source container.

Overview Gammapilot M - FMG60

Recommended application	Sensor	Electronic	Housing	Certificates	
<p>Multifunctional compact transmitter</p> 	<p>Density</p>	<p>Scintillator</p>  <p>NaI - <i>Crystal</i> scintillator Ø50x50 mm (stability 0.1%)</p>	<p>4-wire 90...253 VAC 18...32 VDC</p>	<p>Connection Housing (2 separate connection compartments)</p> 	
	<p>Limit</p>	 <p>PVT- <i>Plastic</i> scintillator □ 40 x L 200</p>		<p>EEx e/d EEx i</p>	 
	<p>Level</p>	 <p>PVT- <i>Plastic</i> scintillator</p>		<p>Operation</p> <p>separate Display FHX 40</p> 	
<p>Interface</p>	<p>□ 40 x L 400 ... 2000mm</p>		<p>ToF-Tool</p> 		
		<p>Software</p>	<p>Field-care</p>	<p>GOST</p>	
		<p>One software for all applications</p>		<p>For limit</p>	
					

FMG60 - Strong arguments

- **Multifunctional compact transmitter** for all measuring tasks
(One software + modular system)

- Designed regarding IEC61508, **SIL2** for limit



- Additional to Ex d → **Ex ia** output

- Communication:



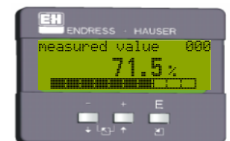
- Sensor: **NaI** + PVT scintillator with high sensitivity + stability

- Certificates:

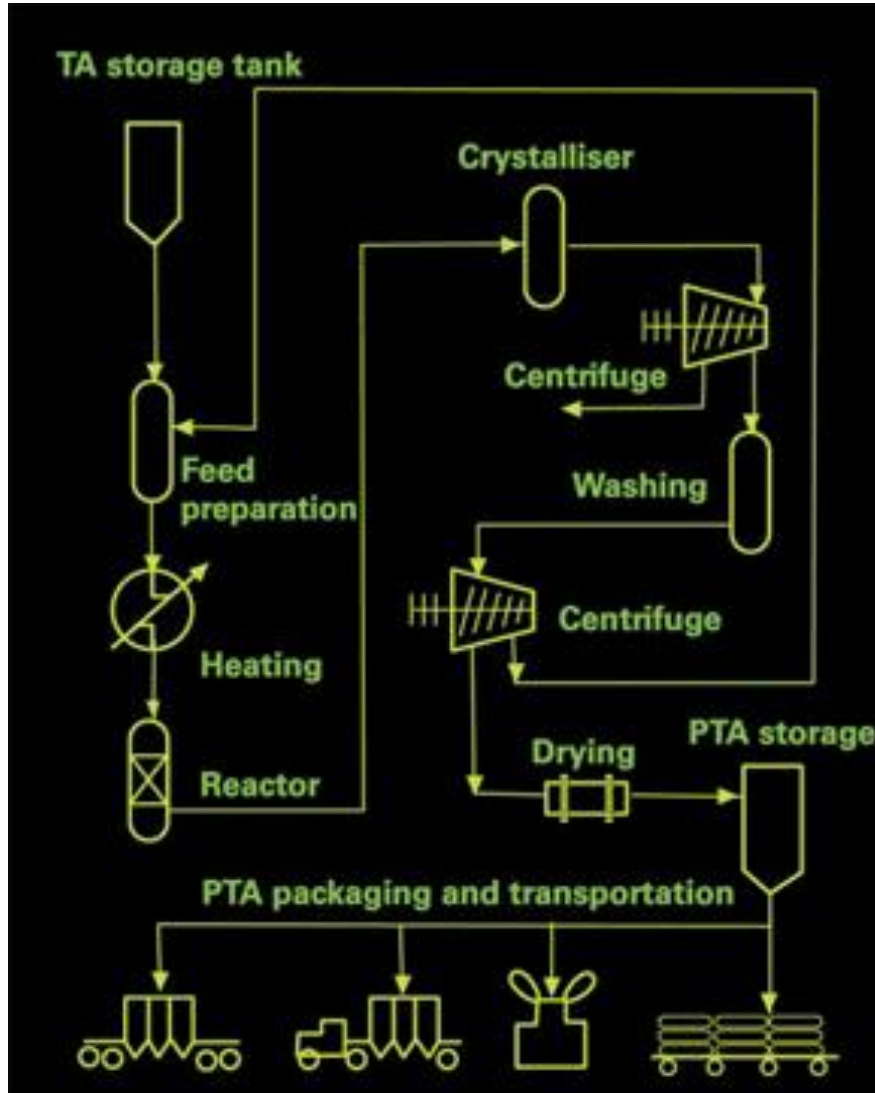


- All mechanical components in **SS 316**

- **Field display** with FHX40 (ToF operation)



Purified Terephthalic Acid (PTA)



Step 2:

Purification

heating + washing

In a fixed bed catalyst reactor the impurities are soluted.
In the centrifuge they are separated from the TA.

PTA ready for packing.

PTA - level measurement in hydro generator

Source is placed inside the vessel.
Dry well installation

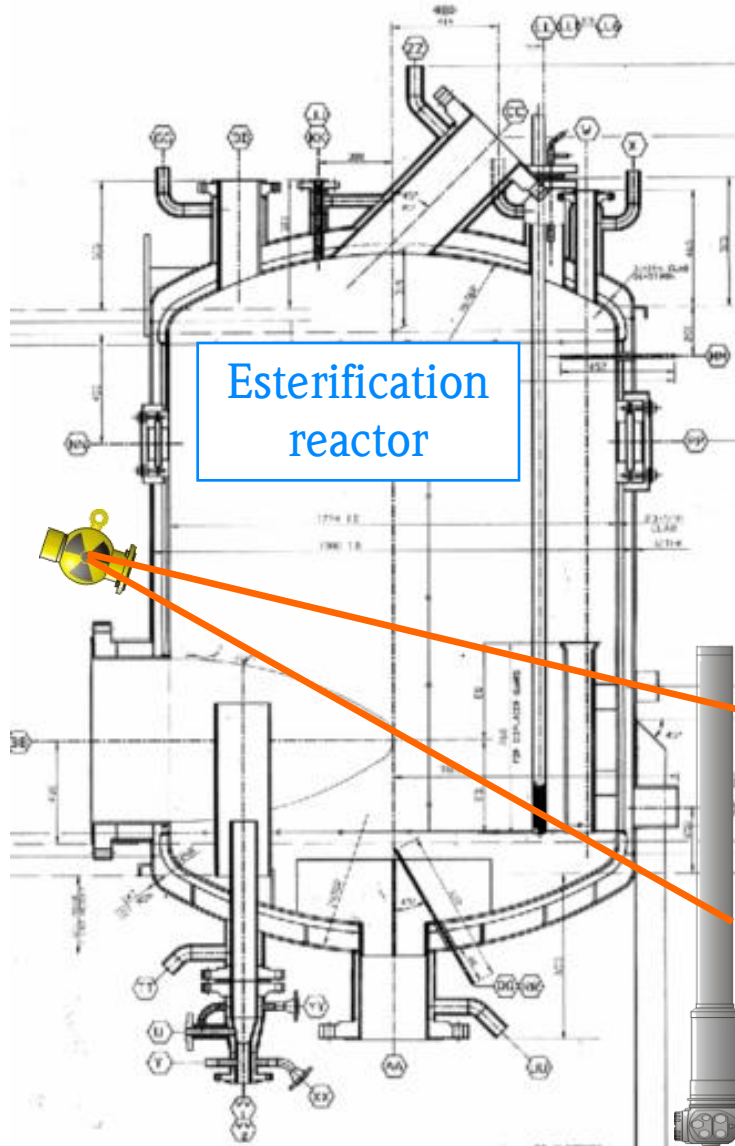


source



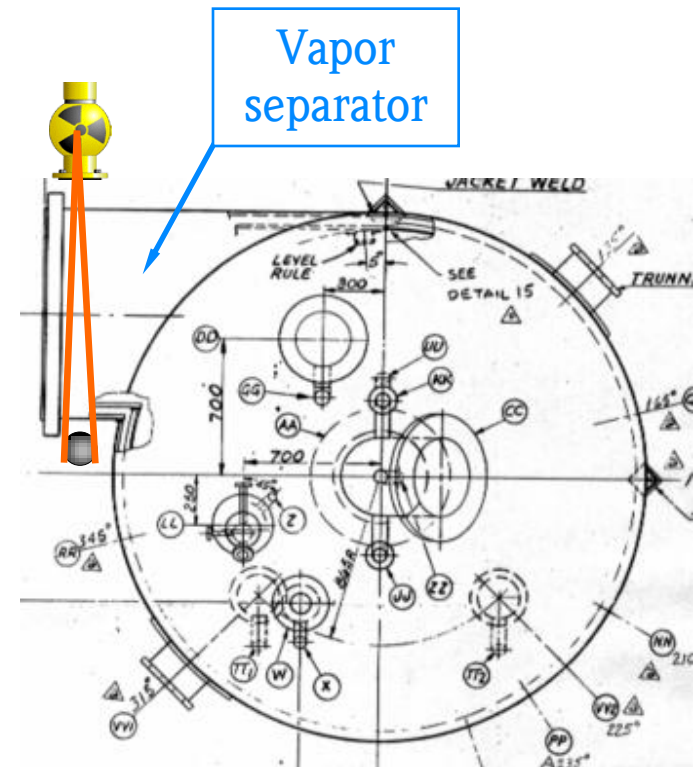
detector

Polyester - Esterification



Application

Level measurement in the esterification reactor OR vapor separator



Polyester - Finisher

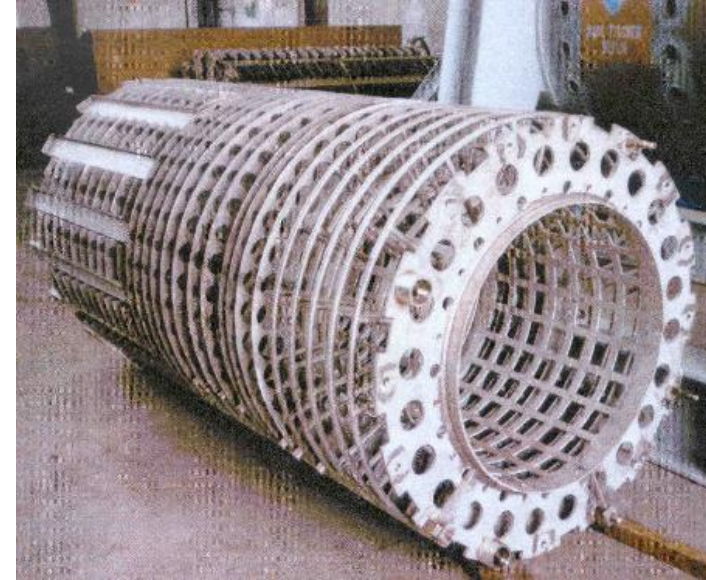
Application

Level measurement in the finisher at the inlet as well as in the outlet.

Level at the inlet and outlet are related to the viscosity of the product.

Advantages

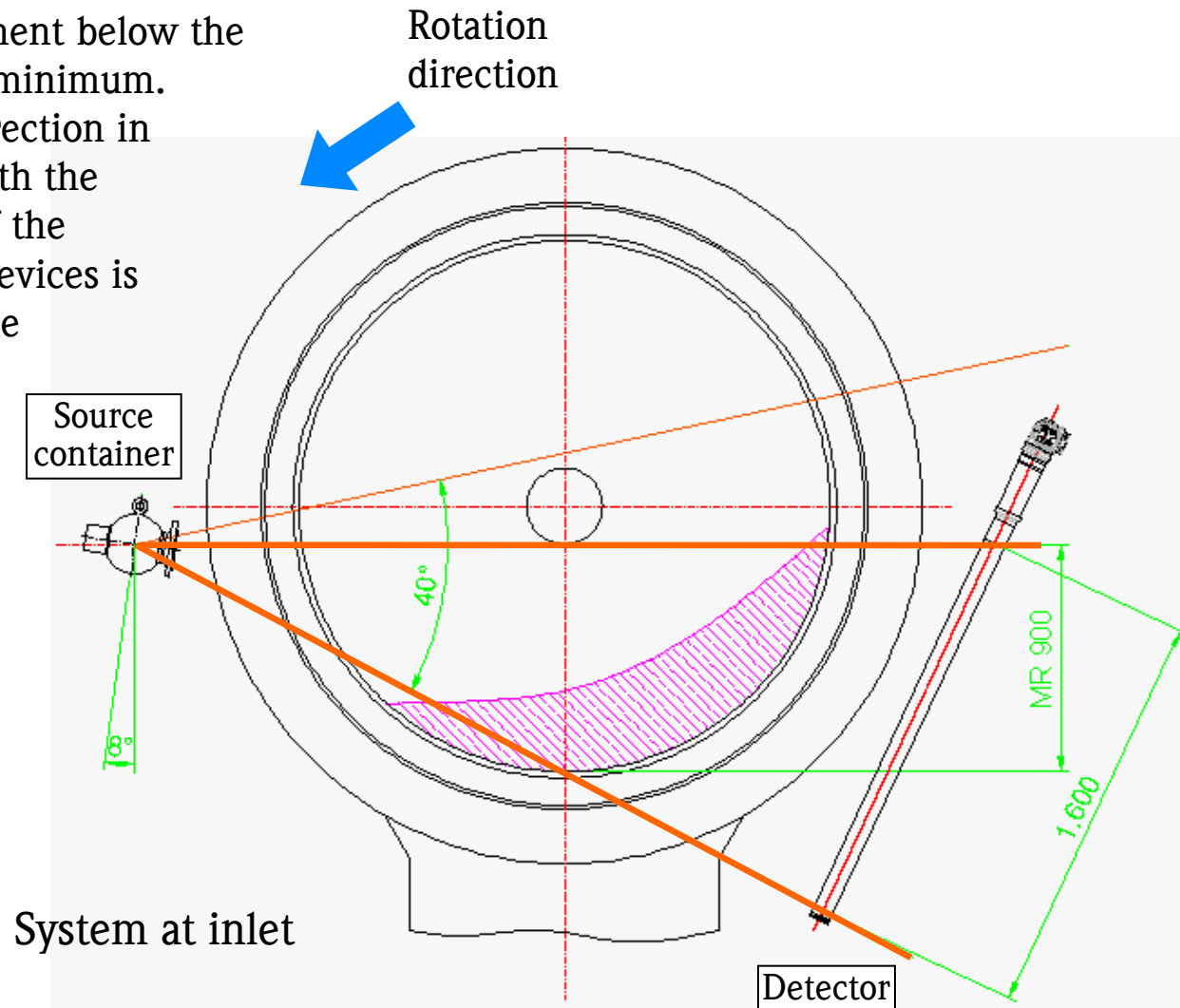
- Non invasive
- Installations have no influence
- Free of maintenance



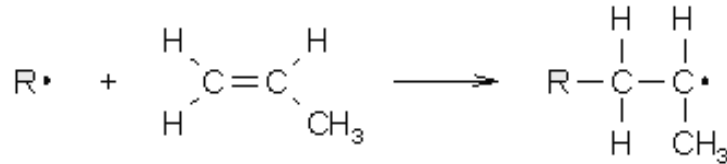
Finisher - Level measurement at inlet

Application

Level measurement below the shaft up to the minimum. The rotation direction in combination with the configuration of the measurement devices is necessary for the functionality.

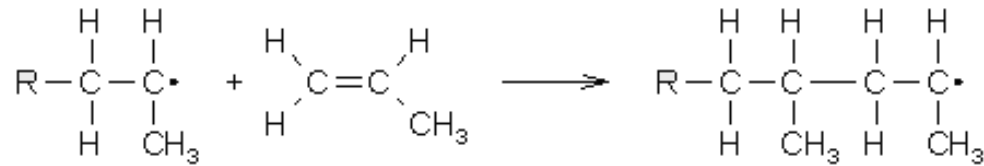


Polypropylene

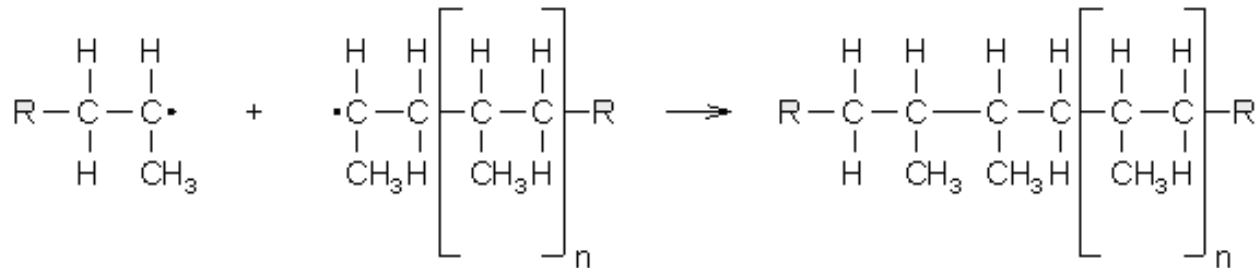


catalyst propylene

activated propylene

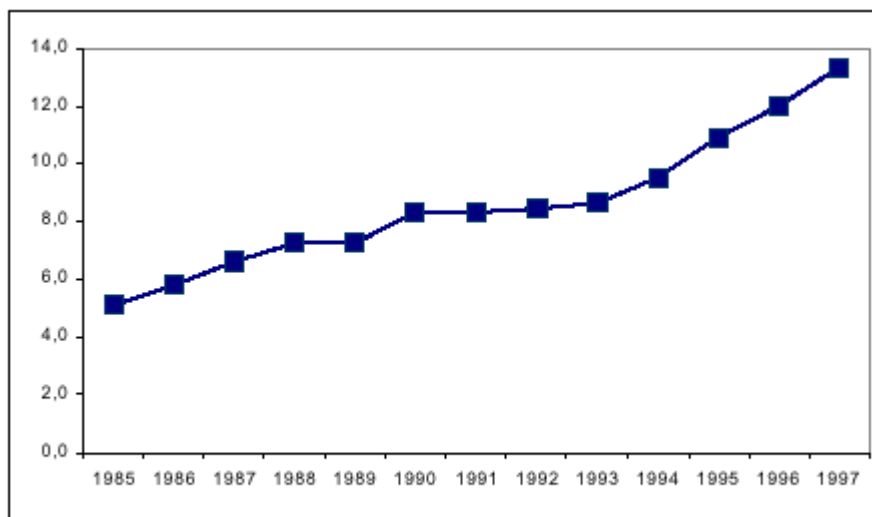


end of polymerisation



Polypropylene – World Production

World production of PP (millions lb)



Note. data include Canada from 1995. *Source.* C&EN (1996, 1997, 1998)

Licensors	Germany	UK	Japan	US	Total
Top Chem. Companies*	1.7	1.4	2.7	3.7	9.5
Other Chem. Companies*	0.1	0.2	0.2	0.3	0.8
SEFs	8.9	8.3	10.4	23.3	50.9
Staff	7.4	5.6	9.5	16.3	38.8
Total	18.1	15.5	22.8	43.6	100.0

**Top Chem. Companies:* Companies in the top 50 positions in terms of number of plants; *Other Chem. Companies:* Companies with more than 5 plants, excluded the top 50 companies.

Source. Chem-Intell, 1998.

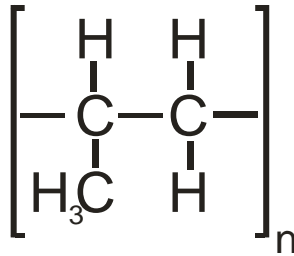
Polypropylene – Producers

Rank	Company	N. of plants	Rank	Company	N. of plants
1	Himont	14	11	China Techimport	5
2	Shell	12	12	Chisso	5
3	Amoco Chemicals	11	13	Mitsui Petrochemical	5
4	Hoechst	9	14	Montedison	5
5	Mobil	9	15	Repsol Quimica	5
6	Techmashimport	8	16	Solvay	5
7	BASF	6	17	Sumitomo	5
8	Exxon Chemical	6	18	DSM	4
9	Hercules	6	19	Huntsman Chemical	4
10	Borealis	5	20	Indian Petrochemicals	4

Source: Chem-Intell, 1998

Polypropylene – Spheripol Process (Basell)

Processes

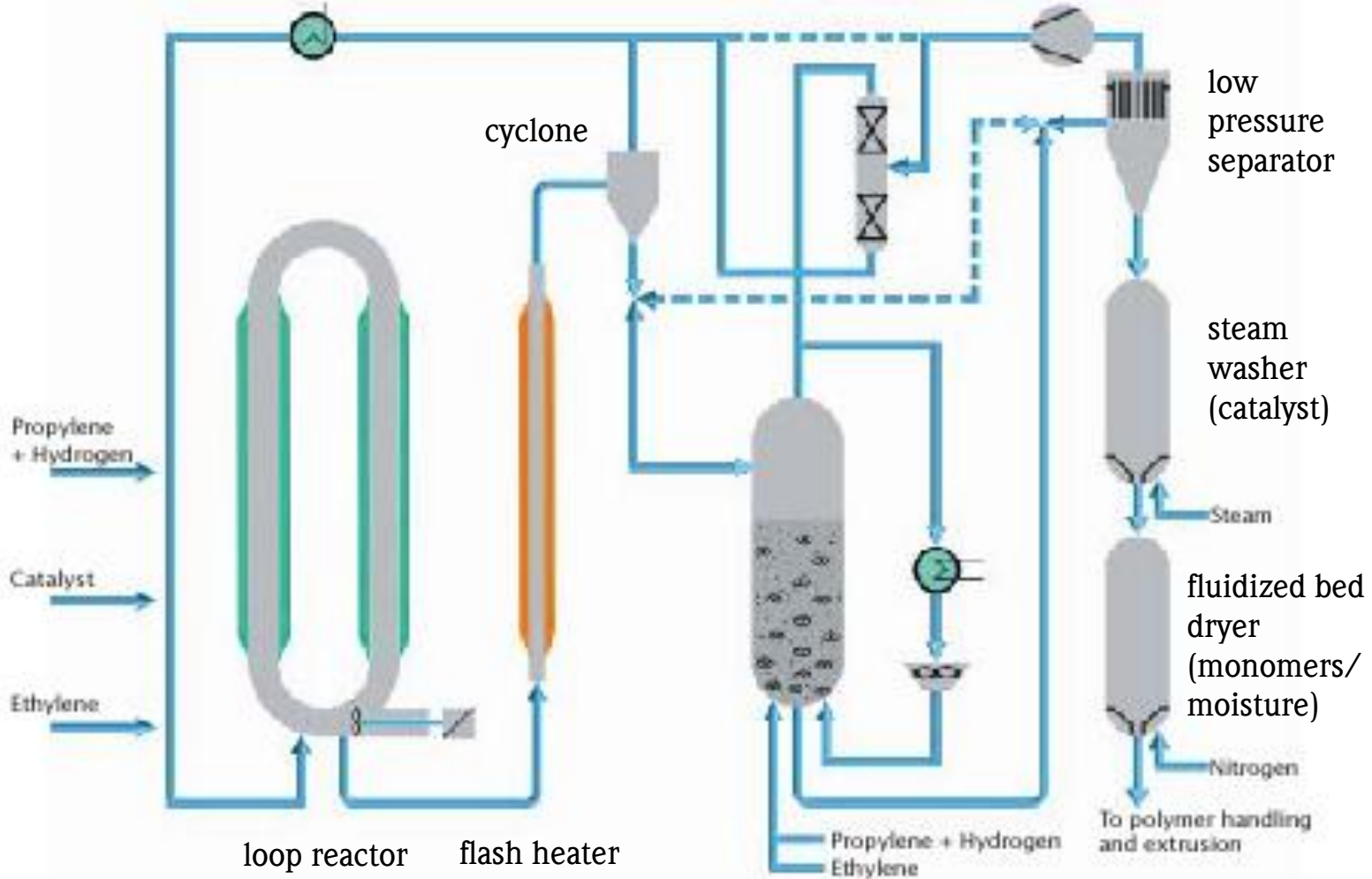


- Spheripol Process (Himont, today Shell)
- Unipol Process (Union Carbide)
- Novolen Process (BASF)

PP has many applications: from nappies and carpets, artificial grass and ships' ropes to car components and surgical garments.

Broadly speaking, applications can be divided in to three groups: **fine fibres, film and moulding applications.**

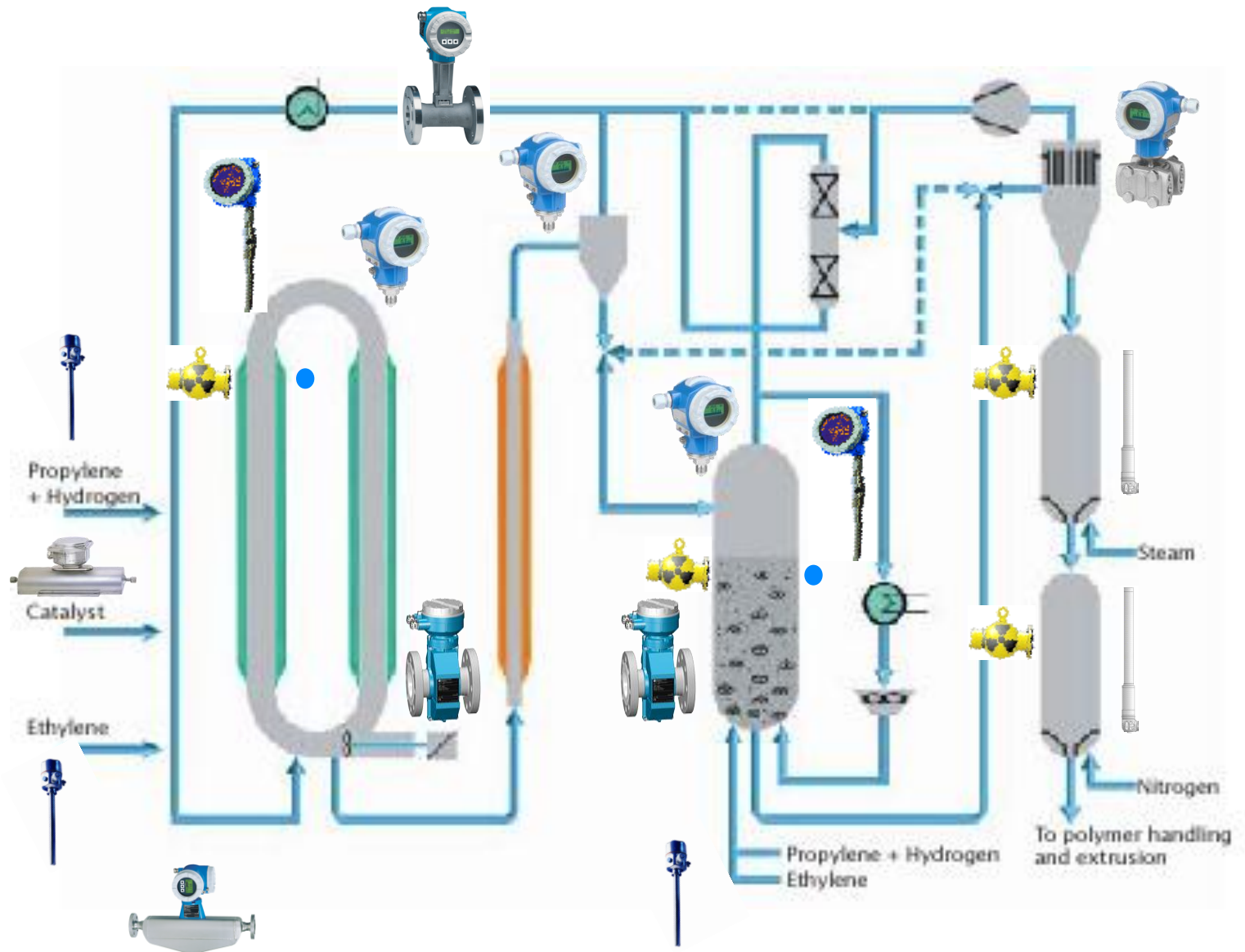
Polypropylene – Spheripol Process (Basell)



Pressure: 35 bar
 Temperature: 70°C

gas phase
 fluidized bed
 reactor

Polypropylene – Spheripol Process (Basell)



Polypropylene – Spheripol Process (Basell)

Instruments used in one process train:

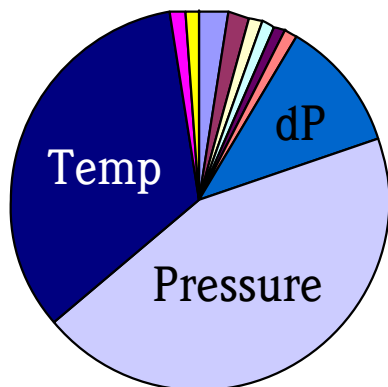
Type	Quantity	Measurement of
coriolis	10	dosing of catalyst mass balance
thermal mass	7	hydrogen gas
magmeters	5	cooling water
vortex	5	recycle gas (propylen / ethylen)
us-flow	5	
diff. pressure	60	
pressure	230	(for interlocks: switches)
temperature	180	(for interlocks: switches)
tuning fork	56	PP in storage silos
TDR	10+	alternative to tuning forks














Polypropylene – Spheripol Process (Basell)

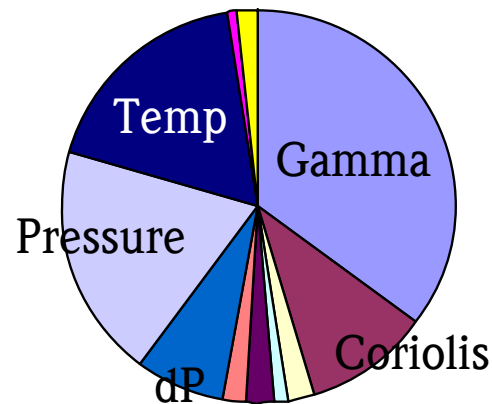













Instrumentation in Spheripol Process (pcs.)



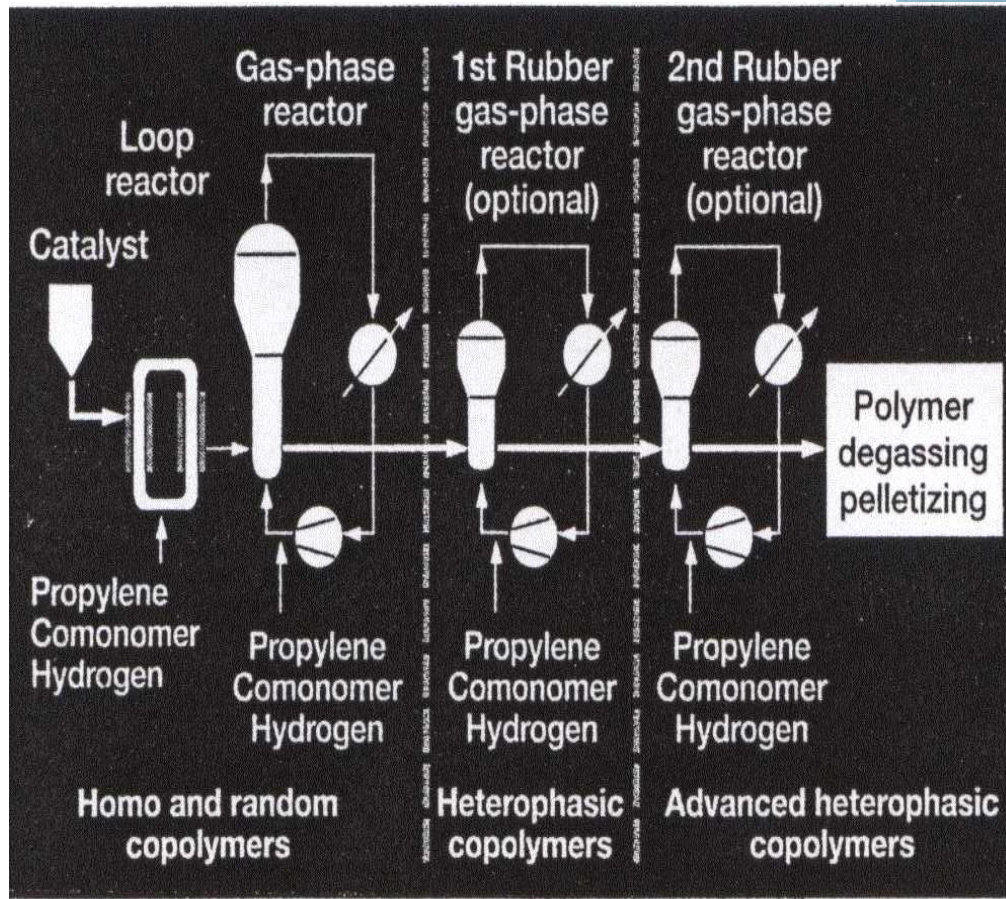
-  Gamma
-  coriolis
-  thermal mass
-  magmeters
-  vortex
-  us flow
-  dP
-  pres
-  tem
-  tuni
-  TDR

Instrumentation in Spheripol Process (turnover)



-  Gamma
-  coriolis
-  thermal mass
-  magmeters
-  vortex
-  us flow
-  dP
-  pressure
-  temperature
-  tuning forks
-  TDR

Polypropylene – Unipol Process



Polypropylene - Unipol Process

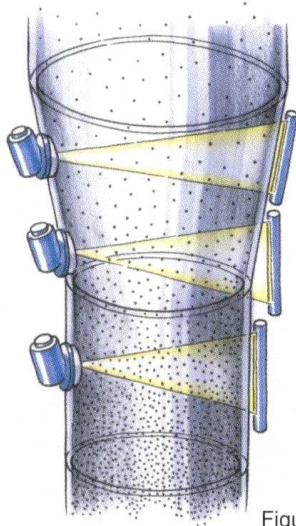


Figure A

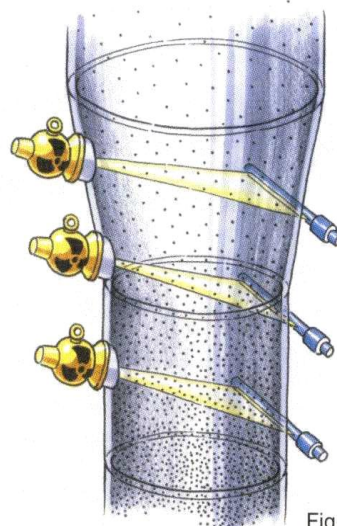
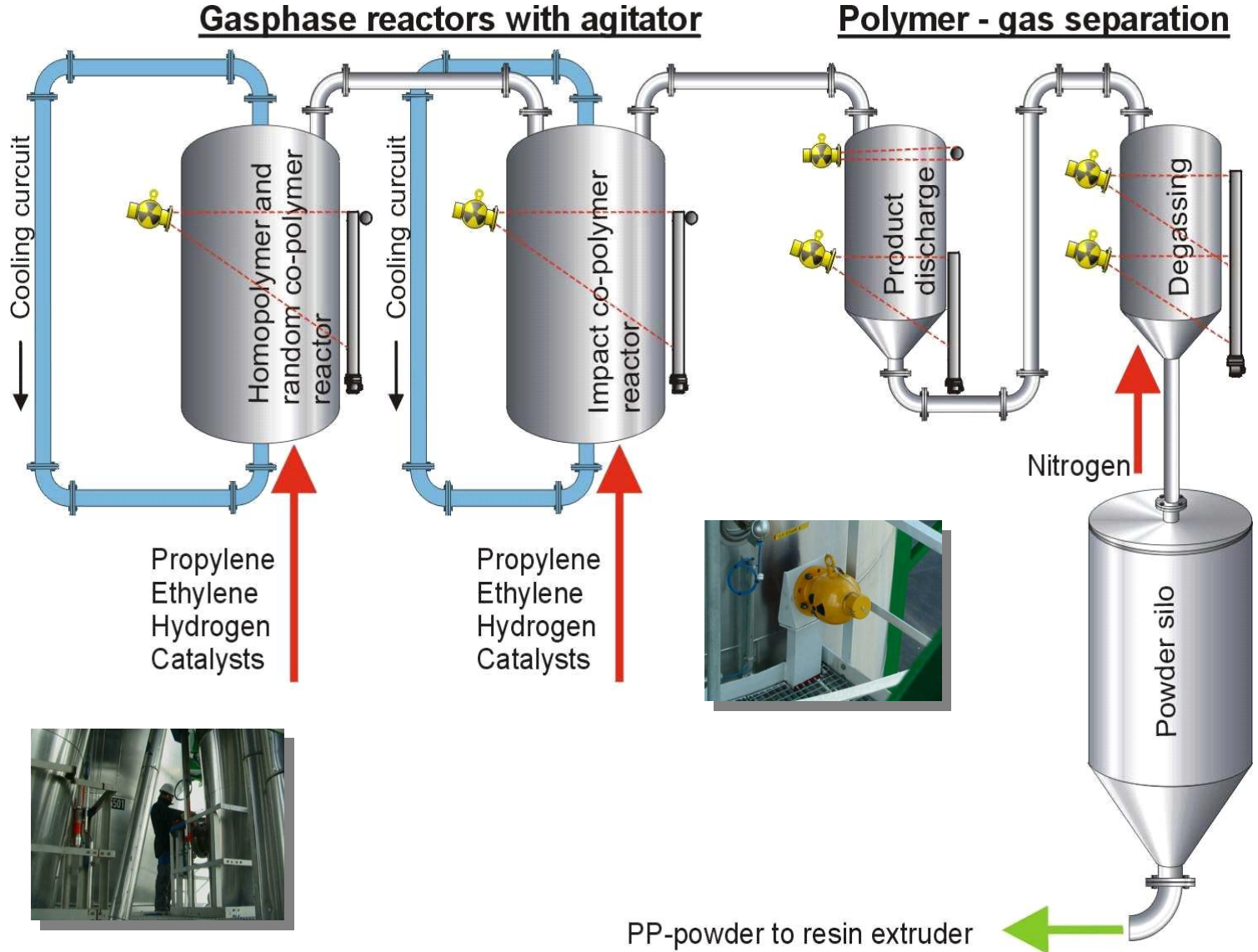


Figure B



Polypropylene - Novolen Process



Polypropylene - Logistics

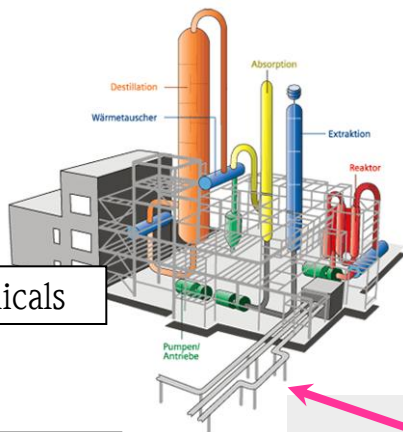


Do not forget:

There are a lot of storage silos for finished product in every petrochemical plant !

FMP40
FMM50
FTM50

Basic Chemicals



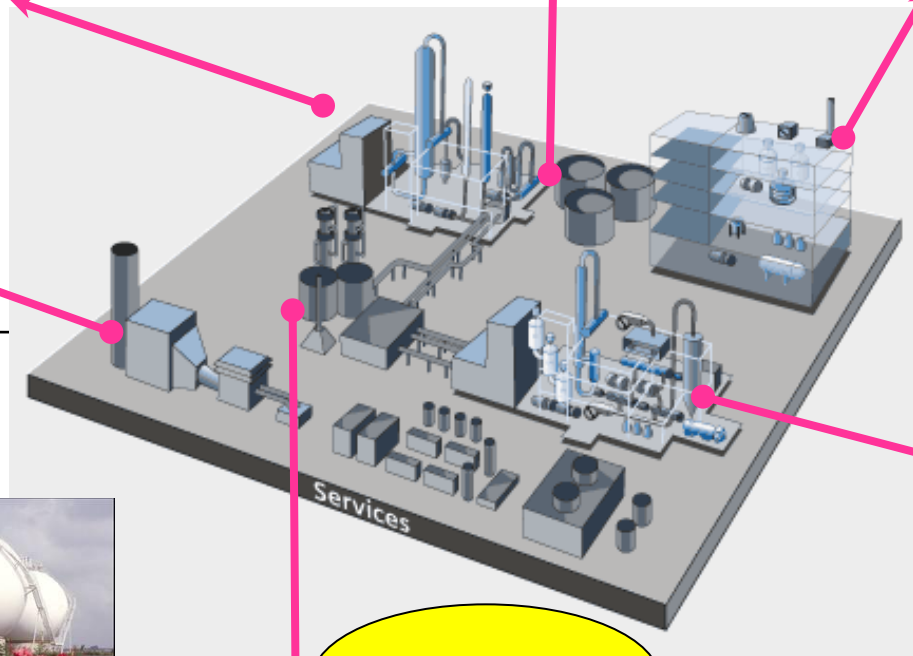
Tank Farm



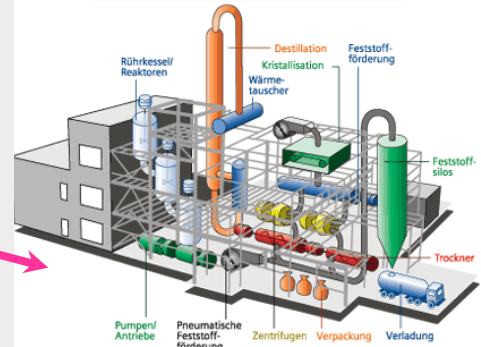
Fine Chemicals



Power Plant



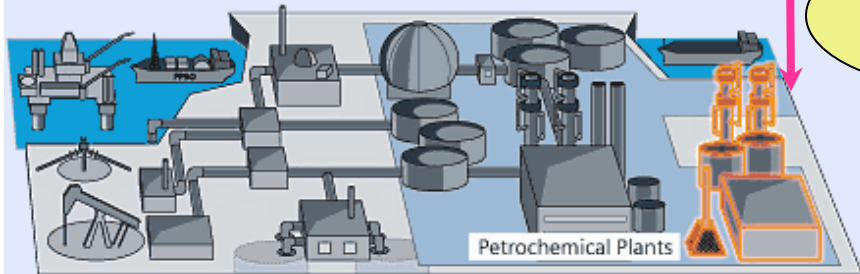
Specialty Chemicals



Oil&Gas



Petro-Chemical
Refineries



Waste Water Treatment



The chemical market

60000 different processes in chemical industry !

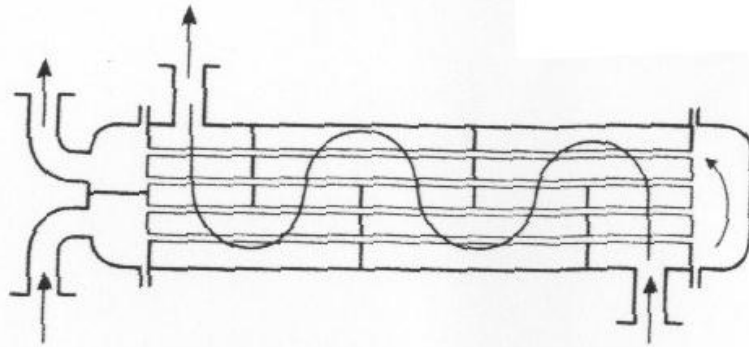
Still about 250 processes in petrochemical industry !

Can we be the experts on that ?

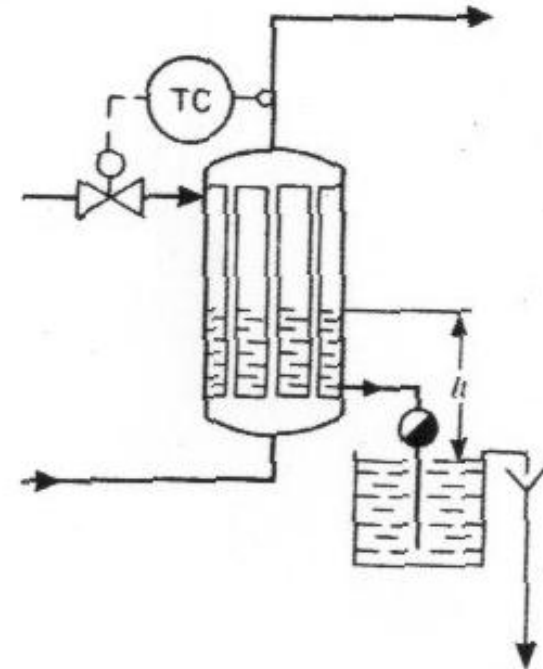
What is the alternative ?

Think in process modules !!

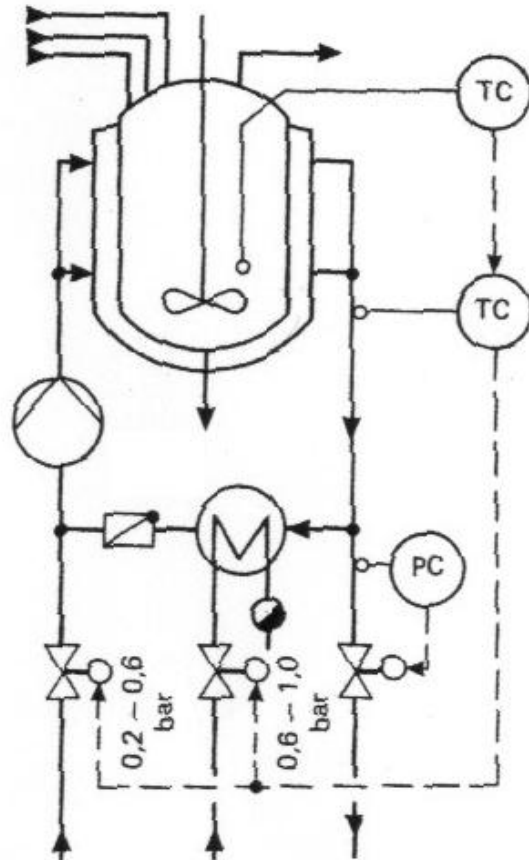
Process modules - heat exchanger



Example:
Condensation of hydrocarbons by using a cooling liquid.
Flow of cooling fluid controlled by temperature measurement of the hydrocarbons.



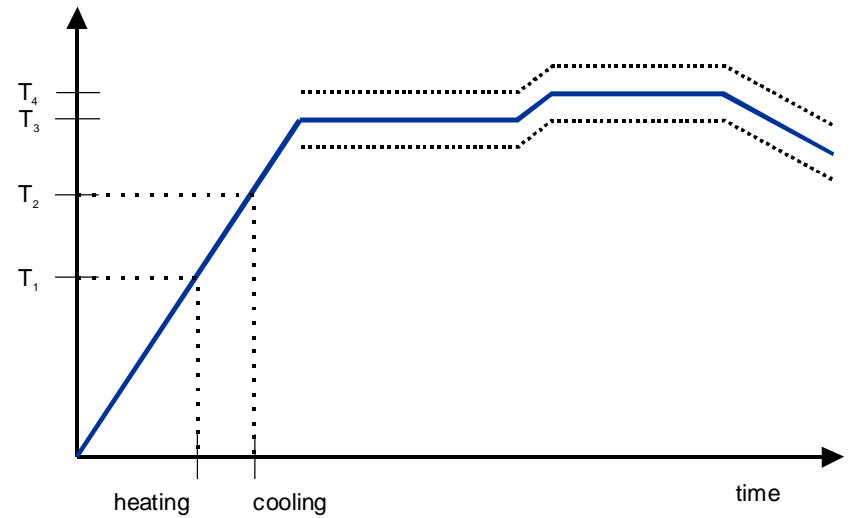
Process modules - process vessel



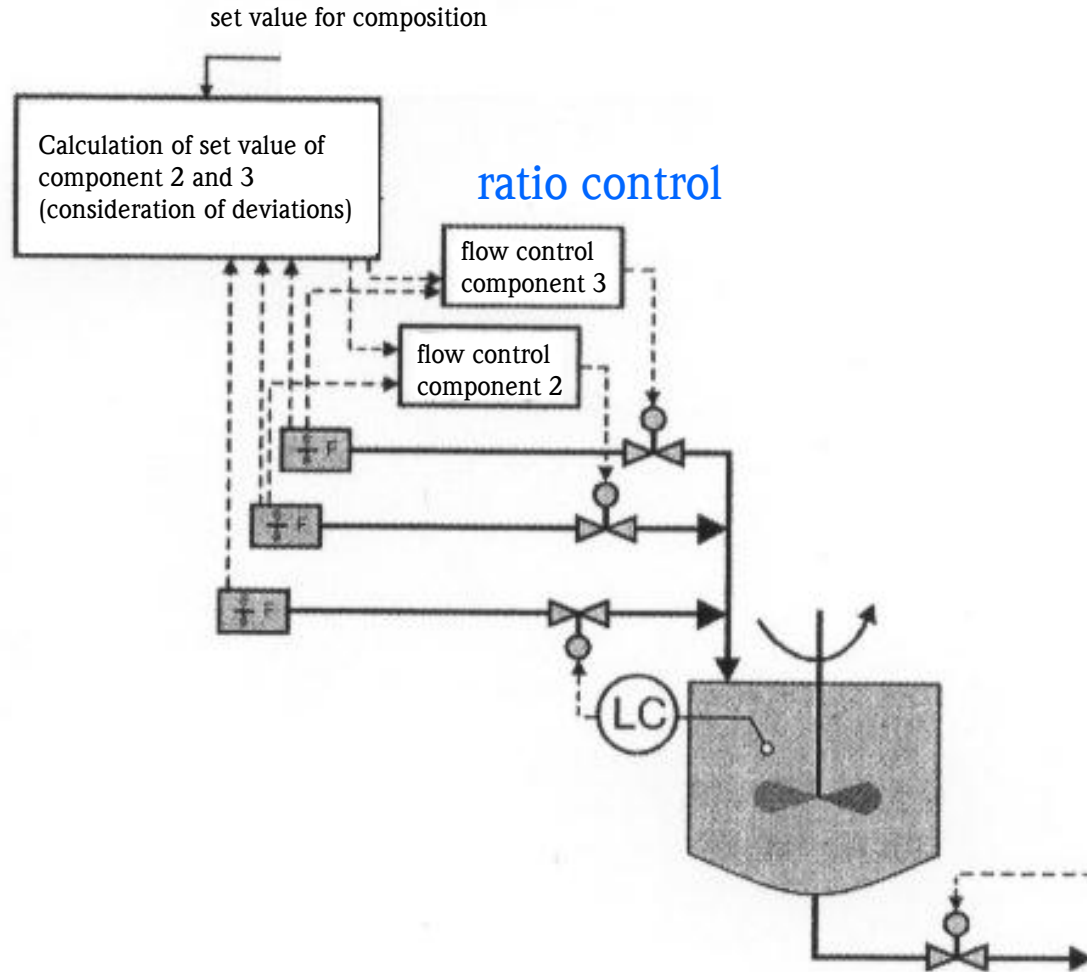
cooling
supply

steam

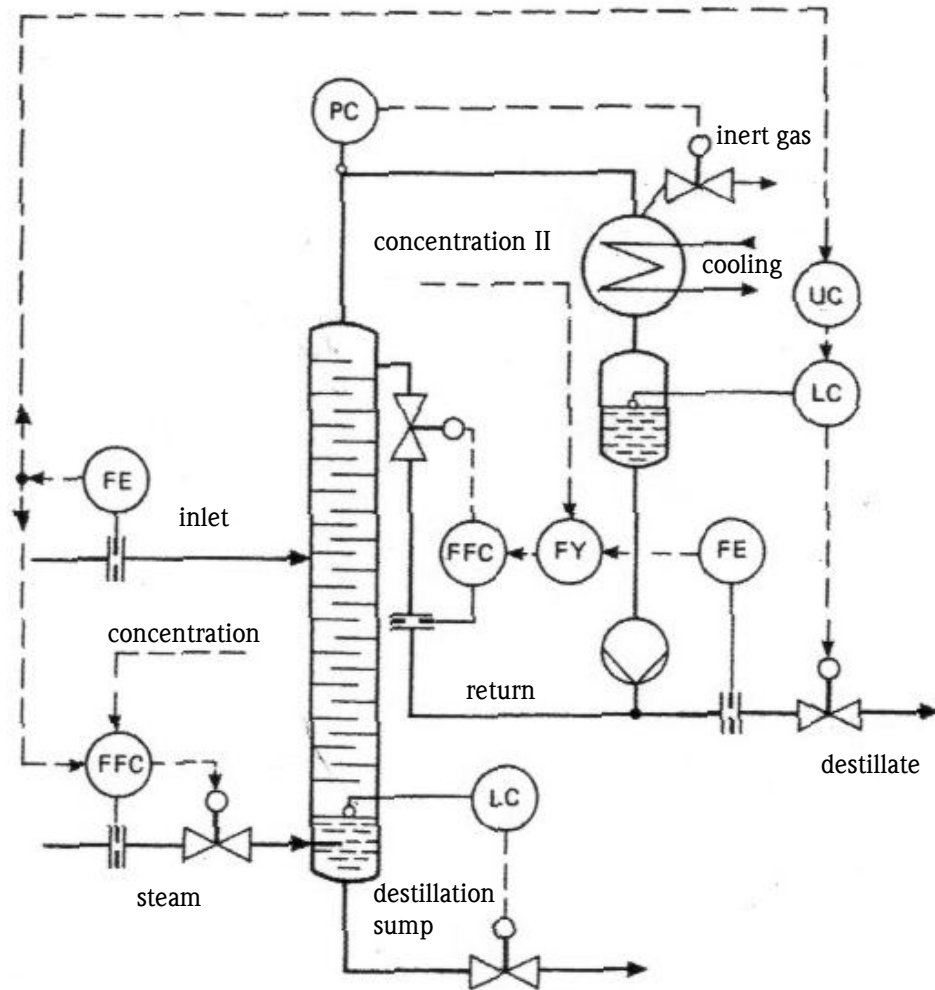
cooling
return



Process modules - inline blending



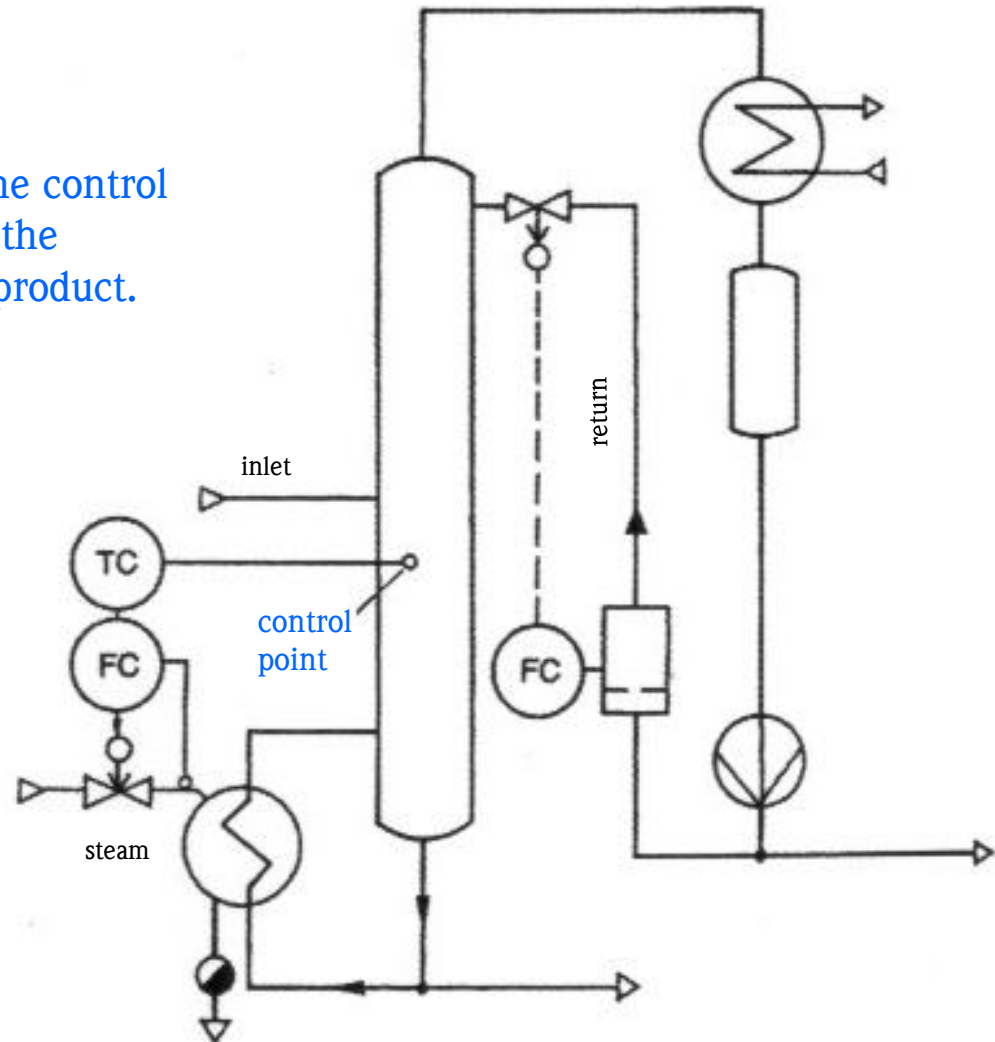
Process modules - distillation column



Process modules - distillation column

Recovery of product

The temperature at the control point is a measure of the concentration of the product.



The chemical market

60000 different processes in chemical industry !

Still about 250 processes in petrochemical industry !

Can we be the experts on that ?

What is the alternative ?

To know what drives the industry and to whom we are talking to !!



The chemical market

What drives the industry ?

- process optimization
- less personnel, less qualified personnel
- process safety and plant safety
- fieldbus instead of analogue instrumentation
- reducing stock
- reducing suppliers
- MAV / MIV
- new technologies (e.g. microplants)

The chemical market - to whom do we talk to ?

Consultants

- cost of ownership
- process optimization
- IMS
- mention news
- fieldbus technology
- **Fieldcare**

Procurement

- cost of ownership
- e-procurement
- internet market place
- W@M
- vendor based inventory control
- **Fieldgate**

The chemical market - to whom do we talk to ?

Engineering department

- safety aspects (Ex, Sil...)
- process optimization
- mention news
- fieldbus technology

Maintenance & operations

- IMS
- predictive maintenance
- service contracts
- Fieldcare
- Fieldgate (remote service)
- CompuCal
- ParaWin